Remarks:

Claim Status

Claims 40, 42-47, 49-54, and 56-60 are currently pending.

Claims 40, 42-47, 49-54, and 56-60 have been rejected.

Applicant respectfully traverses the rejection of claims 40, 42-45, 49-52, and 60 in view of the arguments and amendments herein. Claims 46, 47, and 56-59 are hereby cancelled.

Rejections under §103

Claims 40, 42-45, 47 and 49-52 have been rejected under 35 U.S.C. 103(a) as being unpatentable over Yasuda et al (Nature 2001) in view of Sonnichsen (Physical Review Letter Pub 112002) (as evidenced by Mock (Nano Letters Pub 412002)) and in further view of Pettingell et al (US Patent 6449088 Filed 1993). Claims 46, 47, and 56-59 have been cancelled. Clarifying amendments have been made to the remaining claims and applicant submits that these are allowable over the references whether taken singly or in combination. Claim 40 has been amended to add the limitations of claim 46 and is now allowable over the references as amended and in view of the arguments presented hereinbelow.

Claims 54 and 56-59 are rejected under 35 U.S.C. 103(a) as being unpatentable over Yasuda et al (Nature 2001) in view of Sonnichsen (Physical Review Letter Pub 112002) (as evidenced by Mock (Nano Letters Pub 412002)). Claims 54 and 56-59 have been cancelled.

Claims 46 and 53 are rejected under 35 U.S.C. 103(a) as being unpatentable over Yasuda et al (Nature 2001) in view of Sonnichsen (Physical Review Letter Pub 112002) (as evidenced by Mock (Nano Letters Pub 412002)), and Pettingell et al (US Patent 6449088 Filed 1993) as applied to claims 40 and 47 above and in further view of Felder (US Patent 6232066). Claim 40 now includes the limitations of claim 46. Claim 53 has been canceled.

Claim 40, as amended, is allowable over the references

In the instant application, the incident light source used to illuminate the sample is NOT polarized, but is *nonpolarized* white light. Applicants' invention depends on the

fact that the nanorod scatters polarized light from it upon illumination of nonpolarized light incident upon it. Only the light scattered from the nanorod is polarized. This polarized light is detected by the presence of only one polarizing filter that is placed between the gold nanorod and the detection device (e.g. a camera) used to measure it. This property of the nanorod is taught for the first time in this application and is not obvious to anyone skilled in the art. Also, this placement of using a polarizing filter only after the nanorod, to measure the angle of the light polarized *by* the nanorod is unique to the instant application and is not taught anywhere else.

Neither Sonnichsen nor Mock teaches that the process by which the nanorod scatters the light results in the scattered light becoming polarized. Sonnichsen in Figure 3, illuminates gold nanorods with polarized light. The angle of this incident light relative to the long axis of the nanorod is then varied and the intensity of the scattered light is measured. Mock in Figure 3 E and F, illuminates the silver/gold/nickel nanowires with polarized light along the long and short axes, respectively, and notes the color of the scattered light. Sonnichsen may teach that the polarized light along one axis is not dephased by the other axis, but it does not teach that the light is polarized by the long axis, nor does it teach that the light is polarized by the short axis.

Pettingill et al (US patent 6449088 filed 1993) teaches away from the instant application. Claim 1a of Pettingill et al. states the use of "an illumination source, which produces polarized light that propagates as a beam substantially along an optic axis." The instant application does not employ the use of a polarized light source. Pettingill teaches that an object being imaged will alter the polarization angle of the incident polarized light. An adjustable polarizer will discriminate against the polarized light source, thereby enabling the light from the object with a different polarization angle to be observed more clearly.

Accordingly one skilled in the art could not learn how to use nonpolarized white light to illuminate gold nanorods to filter "first and second polarized wavelengths of the nonpolarized white light through a polarizing filter to detect rotational motion by observing alternating first and second polarized wavelengths of the nonpolarized white light..." Thus claim 40 is allowable over the references whether taken singly or in any

combination. By extension, dependent claims 42-45 and 49-52 including the limitations of claim 40 are also allowable.

Further, Claim 40 has also been amended to add the limitations of claim 46 for "disposing a detection DNA strand between the nanoparticle and the molecular structure, wherein the detection DNA strand hybridizes with a target DNA strand, if the target DNA strand matches the detection DNA strand, to form a structural link between the molecular structure and the nanoparticle thereby causing said nanoparticle rotation." At least this limitation of claim 40 is not properly found in any permissible combination of the references. Thus claim 40 is allowable over the references as are dependent claims 42-45 and 49-52 including the limitations of claim 40.

Yasuda is cited for disclosing attaching a nanobead to an F1-ATPase motor, rotation using a nanobead and imaging with laser. However, Yasuda shows bonding to a rotating arm with biotin and streptavidin and no target matching DNA linkage is shown.

Sonnichsen is cited for disclosing gold nanorods. As evidenced by Mock a property of a nanorod is to alternately produce red and green polarized light when illuminated with polarized white light along the axes. No target matching DNA linkage is shown in Sonnichsen or Mock.

Pettingell et al. discloses using polarizing microscopes which use polarizers.

Felder is cited for disclosing oligonucleotide links as an anchor. No target matching DNA linkage between a rotating molecular motor and a nanoparticle suitable for causing the nanoparticle to rotate is discussed.

Combination of Yasuda and Felder is not permitted under §103 because the references teach away from each other and the combination destroys the intended functions of the references. Turning first to Felder, Felder teaches detection of target molecules by using probes for detection of targets. The probes are defined as: "... a substance, e.g. a molecule, that can be specifically recognized by a particular target." (See, Felder, Col. 4. ll. 34-35) Felder does not use or need rotation to detect targets, nor F_1 -ATPase enzymes to produce rotation.

In contrast, Yasuda teaches the use of gold beads to detect rotation in F_1-ATPase enzymes. The gold beads produce reflections that indicate rotation.

The references are not properly combined because it is not suggested by the references how to combine Yasuda and Felder to achieve the limitations of the present invention without destroying the intended functions of the references. More specifically, the references are not properly combined because it is not suggested by the references how to substitute the rotating beads of Yasuda for the Felder probes while following the teachings of the references.

For example, since Felder does not disclose using rotation to detect targets, combining Felder with Yasuda would destroy the intended purpose of Yasuda which is to detect F_1-ATPase rotation and not non-rotating targets as in Felder. Similarly, there is no suggestion in either of the references for using Yasuda's rotational system combined with Felder to detect targets since Yasuda does not teach target detection by light scattered through F_1-ATPase rotation of gold beads and neither does Felder.

While the combination has been asserted applicant respectfully submits that it has not been shown how the combined references teach the step of disposing a detection DNA strand between the nanoparticle and the molecular structure in a detection system where targets enable the rotation of an F_1–ATPase molecule to be detected. For example, if the structure of Yasuda were substituted for Felder's structure, as shown, for example, in FIG. 1, the "Detection 1" probe would have no useful function, thus destroying Felder's intended technique. This does not even address the fact that Yasuda's structure would also be significantly altered by adding elements from Felder between Yasuda's F_1 -ATPase enzyme and his gold bead. Further still, Felder specifies that his detection probe be "specific for a target of interest" (See, for example, Abstract). Even if it were allowable, hypothetically, to extend the argument to add Sonnichsen's gold particles to the combination, this addition would not solve the improper combination of Yasuda and Felder. Whereas the gold beads of Yasuda or (if allowed to be substituted) gold nanorods are not specific to "a target of interest," but only provide an indication of rotation. Thus, Yasuda and Felder teach away from each other and following their teachings would not lead one skilled in the art to the method of the

present invention. Thus claim 40 is allowable over the references as are dependent claims 42-45 and 49-52 including the limitations of claim 40.

Claim 60, as amended, is allowable over the references

Claim 60 has been rejected under 35 U.S.C. 103(a) as being unpatentable over Yasuda et al (Nature 2001) in view of Sonnichsen (Physical Review Letter Pub 112002) (as evidenced by Mock (Nano Letters Pub 412002)), Felder (US Patent 6232066), and Greenberg (US Patent 53051 39). Applicant respectfully submits that claim 60 is allowable over the references in view of the arguments presented herein.

For a claim to be found obvious in view of the references, all of the claim elements must be found in a properly combined set of references taken as a whole. Here the references do not disclose all of the claimed elements of the invention as set out in amended claim 60.

As argued above with respect to claim 40, in the instant application, the incident light source used to illuminate the sample is NOT polarized, but is nonpolarized white light. Applicants' invention depends on the fact that the nanorod scatters polarized light from it upon illumination of nonpolarized light incident upon it. Only the light scattered from the nanorod is polarized. This polarized light is detected by the presence of only one polarizing filter that is placed between the gold nanorod and the detection device (e.g. a camera) used to measure it. This property of the nanorod is taught for the first time in this application and is not obvious to anyone skilled in the art. Also, this placement of using a polarizing filter only after the nanorod, to measure the angle of the light polarized BY the nanorod is unique to our application and is not taught anywhere else.

Neither Sonnichsen nor Mock teaches that the process by which the nanorod scatters the light results in the scattered light becoming polarized. Sonnichsen in Figure 3, illuminates gold nanorods with polarized light. The angle of this incident light relative to the long axis of the nanorod is then varied and the intensity of the scattered light is measured. Mock in Figure 3 E and F, illuminates the silver/gold/nickel nanowires with polarized light along the long and short axes, respectively, and notes the color of the scattered light. Sonnichsen may teach that the polarized light along one axis is not

dephased by the other axis, but it does not teach that the light is polarized by the long axis, nor does it teach that the light is polarized by the short axis.

Pettingill et al (US patent 6449088 filed 1993) teaches away from the instant application. Claim 1a of Pettingill et al. states the use of "an illumination source, which produces polarized light that propagates as a beam substantially along an optic axis." The instant application does not employ the use of a polarized light source. Pettingill teaches that an object being imaged will alter the polarization angle of the incident polarized light. An adjustable polarizer will discriminate against the polarized light source, thereby enabling the light from the object with a different polarization angle to be observed more clearly.

Accordingly one skilled in the art could not learn how to use nonpolarized white light to illuminate gold nanorods for "detecting alternating first and second polarized wavelengths indicating motion of the nanoparticle and the molecular structure indicating detection of the target DNA strand." Thus, for this reason alone claim 60 is allowable over the references whether taken singly or in any combination.

Further still, as argued above, the references fail to disclose at least the element of disposing a detection DNA strand between the nanoparticle and the molecular structure, wherein the detection DNA strand hybridizes with a target DNA strand such that if the target DNA strand matches the detection DNA strand they form a structural link between the molecular structure and the nanoparticle causing the nanoparticle to rotate… indicating detection of the target DNA strand.

Yasuda is cited for disclosing attaching a nanobead to an F1 ATPase motor, rotation using a nanobead and imaging with laser. However, Yasuda shows bonding to a rotating arm with biotin and streptavidin and no target matching DNA linkage is shown.

Sonnichsen is cited for disclosing gold nanorods. As evidenced by Mock a property of a nanorod is to alternately produce red and green polarized light when illuminated with polarized white light along the axes. No target matching DNA linkage is shown in Sonnichsen or Mock.

As stated above, Felder is cited for disclosing oligonucleotide links as an anchor. No target matching DNA linkage between a rotating molecular motor and a nanoparticle suitable for causing the nanoparticle to rotate is discussed.

Greenberg discloses a polarizing filter and does not otherwise supply claimed elements missing in the disclosures of the other references.

Analogous to the argument above for claim 40, the Yasuda and Felder references in combination teach away from each other and the invention because none of the references, whether taken singly or in any combination, teach the claimed feature that a structural link suitable for rotating a nanoparticle linked to a molecular motor is created by the hybridization of a detection strand and a DNA target strand causing rotation which indicates detection of the target DNA strand. Thus, for this reason alone claim 60 is allowable over the references whether taken singly or in any combination.

Nonstatutory double patenting rejection is moot

Claim 40-59 are rejected on the ground of nonstatutory obviousness-type double patenting as being unpatentable over claims 1-20 of US Patent No. 6,989,235 in view of Sonnichsen (Physical Review Letter Pub 112002) (as evidenced by Mock (Nano Letters Pub 412002)) and Pettingell et al (US Patent 6449088 Filed 1993).

A terminal disclaimer is filed herewith with the applicable fee to overcome the double patenting rejection relating to US Patent No. 6,989,235.

For these reasons, and in view of the above amendments, this application is now considered to be in condition for allowance and such action is earnestly solicited.

Respectfully Submitted,

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